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**(54) Pulping with amphoteric surfactant additive**

(57) In a chemical process for the manufacture of wood-pulp one or more amphoteric surfactants are included in the cooking liquor to reduce the cooking time. The liquor may be alkaline e.g. a Kraft or soda liquor, or an acid or neutral sulphite or bisulphite liquor. One or more surfactants of other type e.g. non-ionic or fluorinated surfactants may be used in combination therewith.

GB 2 155 966 A

## SPECIFICATION

## Pulping process

5 This invention relates to an improved process for the manufacture of wood pulp, useful in the manufacture of paper and for other purposes. 5

In the manufacture of wood chips the chips are first digested under alkaline, acid or neutral conditions.

In the Kraft or sulphate process, wood chips are treated (cooked) at high temperatures with an alkaline solution containing a mixture of sodium hydroxide, sodium sulphide and sodium carbonate in order to obtain sulphidation of the lignins and thus their dissolution. In the sulphite process an acidic or neutral solution containing sulphites and bisulphites is used for dissolving the lignin. The processes are usually carried out so that the chips are subjected to the chemical treatment starting at a temperature below 100°C and gradually bringing the temperature up in the region of 150–180°C. 15

A well known problem is that the penetration of the chemicals into chips is slow and incomplete. This can allow some lignin to polymerize before it has time to dissolve, and results in a high lignin content (Kappa value) of the pulp and a considerable amount of undigested fibres (screen reject). In the Kraft process for example the penetration is optimized by allowing 1.5–3 hours for the gradual raising of the temperature. Even so, the problem still exists, and in order to obtain an acceptably low Kappa value and low screen reject it has to be compensated by prolonging the cooking the cooking at maximum temperature for a few hours, with a resulting degradation of carbohydrates and loss of pulp yield. 20

It has been previously suggested that the penetration of chemicals into the wood structure would be aided by a surface active agent. However, attempts to improve the pulping processes by the addition of surface active agents have so far been unsuccessful and such agents are not used in current processes. 25

It is an object of this invention to provide additives which show demonstrable advantages in assuring penetration of the chemicals and dissolution of the lignin with not more than normal carbohydrate degradation in a considerably shorter cooking cycle. I have surprisingly found that the desired advantages are obtained to a substantial and economically very important degree by adding to the pulping liquor small amounts of an amphoteric surface active agent. 30

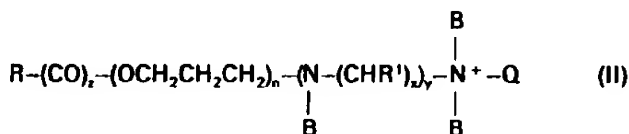
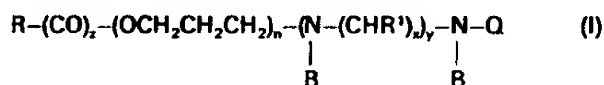
The invention in general terms is thus concerned with a process for the manufacture of pulp in which there is included in the cooking liquor one or more amphoteric surface active agents.

35 The cooking liquor may be any liquor such as conventionally used in the manufacture of pulp and may be alkaline, acid or neutral. The liquor may thus for example be an alkaline liquor such as a Kraft or soda liquor, or an acid or neutral sulphite or bisulphite liquor. The chemical constitution of these liquors is very well known to pulp manufacturers and is described for example in "Pulping Processes", S.A. Rydholm (Interscience Publishers, 1965).

40 The process of the invention is of greatest advantage in connection with alkaline liquors, particularly liquors such as normally used in the Kraft process. 40

The surface active agent used should of course be one which is stable in and soluble in the cooking liquor.

The surfactant is preferably of the type having the general formula (I) or (II), particularly the former: 45



where R is a C<sub>8-20</sub> hydrocarbyl group, optionally substituted;

R' is H or C<sub>1-8</sub> alkyl;

60 B is H, alkyl, substituted alkyl, or a group Q as defined below; 60

Q is an anionic moiety;

x is 2 to 6;

y is 0 to 5;

z is 0 to 1, and

65 n is 0 or 1 (z being 0 when n is 1). 65

In these compounds, R may for example be a straight or branched alkyl or alkenyl group or cycloalkyl-alkyl (e.g. cyclohexyl-alkyl) group, an aralkyl or aralkenyl group (e.g. phenalkyl or phenalkenyl) in which the alkyl or alkenyl portion contains at least 6 carbon atoms; or the hydrocarbyl portion of a resinic acid containing at least two fused rings, e.g. as in the tricyclic pine resin acids such as abietic acid. R is preferably a C<sub>10-18</sub> alkyl group, e.g. a C<sub>12</sub> group. R may for example be the hydrocarbyl portion of lauric or coconut fatty acid, both of which contain a high proportion of C<sub>12</sub> constituents. An example of an unsaturated R group is oleyl and an example of a branched chain group is C<sub>18</sub>H<sub>33</sub>CH(CH<sub>3</sub>)-. The aliphatic portion of R may for example be substituted by hydroxy, as in hydroxystearyl, or by -COOH (e.g. at the 2-position).

10 R' is usually a hydrogen atom, but may be an alkyl group such as methyl. 10

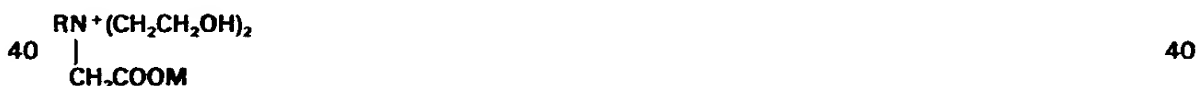
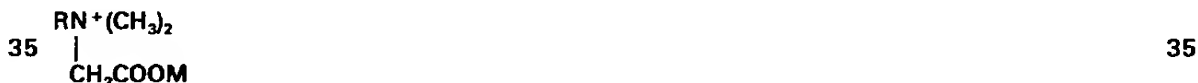
When B is an alkyl group, it may have 1-6, preferably 2-4, carbon atoms, and is preferably a straight chain group. Examples of such groups are methyl and ethyl. The alkyl group may be substituted, for example by hydroxy, as in 2-hydroxyethyl, or by amino.

The group Q may for example be of the formula -R<sup>2</sup>COOM where R<sup>2</sup> is a C<sub>1-8</sub> alkylene group (such as methylene or ethylene) and M is hydrogen or an alkali metal, alkaline earth metal, ammonium or substituted ammonium ion (e.g. mono-, di- or tri-hydroxyethylammonium). M is preferably sodium, and R<sup>2</sup> is preferably methylene. 15

x is preferably 2 and y is preferably 0 or 1.

In surfactants of formula (II) the associated anion may for example be halide (e.g. chloro or bromo). 20

The surfactant thus preferably has one of the following structures:



One or more amphoteric surfactants may be used as cooking liquor additives in my process. Also, the amphoteric surfactants may be used in combination with one or more surfactants of other types, or example nonionic or fluorinated surfactants. In this latter respect, the amphoteric surfactant can have the effect of solubilising surfactants of other general types which are stable in the cooking liquor but not normally soluble in it. 50

The surfactant or surfactants may generally be used in amount for example of up to 2% (e.g. 0.01%-2.0%) of the cooking liquor, and preferably in amounts of 0.1 to 0.6% by weight. It will be appreciated that except as regards the addition of the surfactant, the cooking process is carried out in generally the same manner as in conventional practice, again for example as described in "Pulping Processes", referred to above. The cooking time can however be reduced as demonstrated below, particularly under alkaline conditions. 55

Tests have shown that the addition of, for example, 0.5% based on the cooking liquor, of a surfactant of this type will reduce the required cooking time and the percentage of screen reject substantially in the Kraft process and also in the sulphite process. The reasons why the surface active agents of the invention are superior to those previously tried are not clear. Attempts to correlate the effect to the lowering of surface tension have not been successful, and the mechanisms involved are probably complex. 60

65 The following examples illustrate the invention. 65

0.01%  
- 2.0%

#### Example 1

A series of Kraft cooking trials in autoclaves were carried out with and without the additives of the invention. The additives employed were amphoteric surfactants of the general structure shown in formula 1 and were obtained from Rexolin Chemicals of Helsingborg, Sweden, under the trade name of Rexoteric XCE and XJO. The amounts used were 0.5% of the cooking liquor (white liquor). In order to demonstrate the beneficial effect of the additives on the penetration of the chips, the time allowed for the gradual heating to maximum temperature, normally 2.5 hours, was only 45 minutes in all the trials. After the cooking was continued for the time required to obtain the Kappa values desired, it was shown that when using said additive at Kappa No. 60 the residue of undigested fibres (screen reject) was 0.9%, the same residue amounting to 4% when not using the additive at the same Kappa number. At Kappa No. 70 the undigested fibres were 1.1% when using the additives in the cooking liquor and was 6% when using the cooking liquid without the additives. At Kappa No. 35 the residue on the screen was 0.5% with the additives and 1.5% without the additives.

#### Example 2

A series of sulphite cooking trials were carried out using as an additive 0.5%, based on the acidic cooking liquor, of Rexoteric XJO mentioned in Example 1. Trials without the additive were made for comparison. The temperature was raised from 20 to 105° in 1.5 hours, and in order to demonstrate the effect of the additive the standstill at 105°C normally employed in order to obtain a good penetration was omitted. Instead, the heating was continued and the final cooking temperature of 132°C was reached in 1 hour. After the cooking was continued for the time required to obtain the Kappa values desired, it was shown that when applying said additive at a Kappa No. of 50, the residue of undigested fibres was 2.8%. The same residue amounted to 5.5% without the additive.

#### CLAIMS

1. A process for the manufacture of wood-pulp in which one or more amphoteric surface active agents are included in the cooking liquor.
2. A process as claimed in claim 1 wherein the surface active agent is present in the cooking liquor in an amount of up to 2% by weight.
3. A process as claimed in claim 1 wherein one or more non-amphoteric surface active agents are also included in the cooking liquor.